Diffuse galactic gamma ray emission

- is an allsky feature
- carries important information on galactic cosmic rays
- veils other sources of gamma ray emission

The intention of this IDS program is to provide

- an extensive physical analysis of diffuse galactic gamma ray emission
- a continuously refined model of the diffuse emission to be used for foreground estimation by the GLAST team and GO's.

The scientific goal

The main emission processes of diffuse emission are known.

π^0-decay • bremsstrahlung • inverse Compton

Their relative contributions depend on the cosmic ray particle spectra.

We have data on the local cosmic ray spectra

... but are they representative for the Galaxy?

EGRET data:

intensity > 1 GeV is 60 % higher than model predictions.

This excess may be explained by

discrete, non-stationary cosmic ray electron sources.

Some SNR show X-ray synchrotron emission.

One of them (SN1006) shows TeV invers Compton emission.

$\Rightarrow$ At least some SNR accelerate CR electrons to $\gg$ TeV energies.

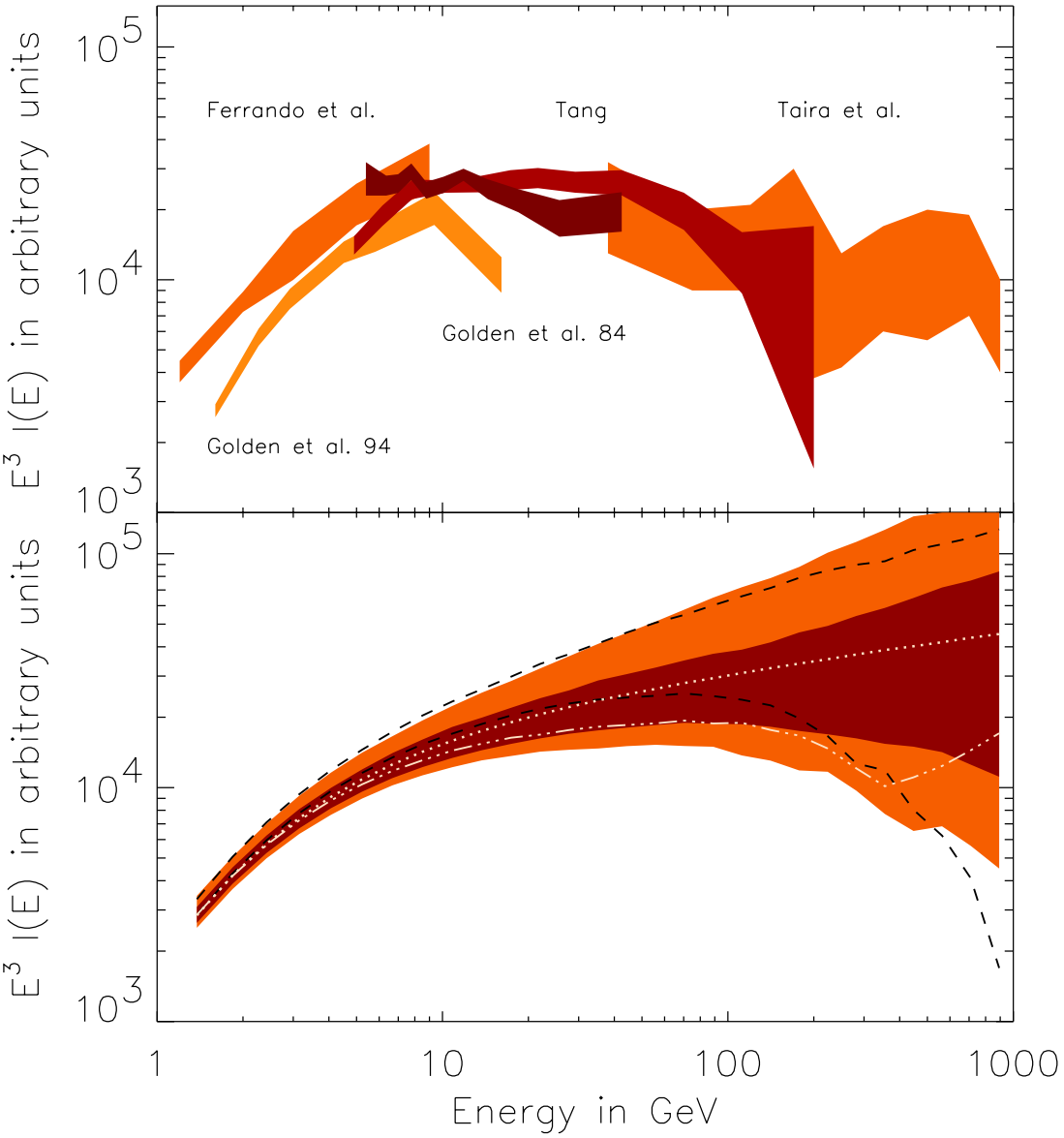
What if CR electrons are predominantly produced in SNR?

We have to perform a time-dependent 3D propagation calculation for cosmic ray electrons.

Take galactic SNR rate of 1/(50 years).

Pick random locations and explosion times.

What do you get? **Swiss Cheese**



Here the electron injection spectral index is 2.0.

In stationary models the injection spectral index has to be 2.4!

$\Rightarrow$ > 1 GeV IC emission may be a factor of 10 higher!

The GeV excess may be caused by IC emission

provided there are few SNR within 1 kpc and the last 10^6 million years.

But what about Gould's Belt?

We will derive the geometry and history of supernova production in the Belt.

Then we will use this as the primary source term in a time-dependent cosmic ray propagation model.

We'll use the local cosmic ray data and the indirect observations for comparison.

This allows us

- to test the swiss cheese scenario in general
- to predict and model a number of consequences.

The GLAST science objectives

- Molecular Clouds

  – X-factor vs. illumination –

- Dark matter

  – gamma ray constraints on baryonic dark matter –

- Gamma ray background

  – extragalactic or galactic IC emission? –

- Extended sources

  – spectral variations in foreground/background –

Implementation and software requirements

The foreground model will be one or possibly a few matrices of sky intensities.

The matrices will have three coordinates, one for photon energy and two for position.

No limitations to the choice of data analysis software!

I recommend that the observers use forward-folding to get count estimates in detector space.

The output may be binned or a continuous probability function,

Note, however, that the angular resolution is always limited!

I intend to produce uncertainty matrices in parallel, so that the systematic uncertainty in the count estimate can be taken into account.

Note that this would result in non-Poissonian distributions!